

WHAT IS CLAIMED IS:

1. An apparatus for the fluidized catalytic cracking of hydrocarbons, the apparatus comprising:

a reaction zone in which blended catalyst is contacted with a hydrocarbon feed;

a separator vessel for receiving effluent from said reaction zone and separating said effluent into a vapor product and spent catalyst;

a recycled catalyst conduit communicative with said separator vessel for passing spent catalyst to said reaction zone, said recycled catalyst conduit including a recycled catalyst control valve for regulating spent catalyst circulation and instrumentation for determining the circulation rate of spent catalyst through said recycled catalyst conduit;

a regeneration zone for removing carbon from said spent catalyst to provide regenerated catalyst;

a spent catalyst conduit communicative between said separator vessel and said regeneration zone for passing spent catalyst to said regeneration zone;

a regenerated catalyst conduit communicative between said regeneration zone and said reaction zone for passing regenerated catalyst from said regeneration zone to said reaction zone, wherein said regenerated catalyst is blended with said spent catalyst to provide said blended catalyst, said regenerated catalyst conduit including instrumentation for determining the

circulation rate of regenerated catalyst through said regenerated catalyst conduit; and

a recycle catalyst controller for setting a position of the recycle catalyst control valve dependent on whether a relationship between the circulation rate of spent catalyst through said recycle catalyst conduit and the circulation rate of regenerated catalyst through said regenerated catalyst conduit meets a preset condition.

2. The apparatus of claim 1 wherein said regenerated catalyst conduit includes a regenerated catalyst control valve for regulating regenerated catalyst circulation to said reaction zone.

3. The apparatus of claim 1 wherein said reaction zone comprises a riser.

4. The apparatus of claim 3 wherein a base of said riser comprises a blending vessel in which recycled catalyst and regenerated catalyst are blended.

5. The apparatus of claim 1 wherein said separator vessel includes a stripping vessel for stripping hydrocarbons from said spent catalyst and said spent catalyst conduit and said recycle catalyst conduit are communicative with said stripping vessel.

6. The apparatus of claim 1 wherein the relationship between the circulation rate of spent catalyst through said recycle catalyst conduit and the circulation rate of regenerated catalyst through said regenerated catalyst conduit is the ratio of a sum of the circulation rate of spent catalyst through said recycle catalyst conduit and the

circulation rate of regenerated catalyst through said regenerated catalyst conduit to the circulation rate of regenerated catalyst through said regenerated catalyst conduit.

7. The apparatus of claim 1 wherein the position of the recycle catalyst control valve is set relative to fully open.

5 8. The apparatus of claim 1 wherein said controller signals a setting to a low signal selector, said low signal selector also being receptive to signals of a setting from at least one other controller and said low signal selector signals the lowest setting to the recycle catalyst control valve.

10 9. The apparatus of claim 8 wherein a pressure differential indicating controller signals a setting signal to the low signal selector based on a pressure differential determined across said recycle catalyst control valve.

10. The apparatus of claim 8 wherein a temperature indicating controller signals a setting signal to the low signal selector based on a temperature of said regeneration zone.

15 11. An apparatus for the fluidized catalytic cracking of hydrocarbons, the apparatus comprising:

a riser in which blended catalyst is contacted with a hydrocarbon feed;

a separator vessel for receiving effluent from said riser and separating said

effluent into a vapor product and spent catalyst;

20 a recycle catalyst conduit communicative with said separator vessel for passing

spent catalyst to a base of said riser, said recycle catalyst conduit including a

recycle catalyst control valve for regulating spent catalyst circulation and instrumentation for determining the circulation rate of spent catalyst through said recycle catalyst conduit;

a regenerator vessel for removing carbon from said spent catalyst to provide regenerated catalyst;

a spent catalyst conduit communicative between said separator vessel and said regenerator vessel for passing spent catalyst to said regenerator vessel;

a regenerated catalyst conduit communicative between said regenerator vessel and the base of said riser for passing regenerated catalyst from said regenerator vessel to the base of said riser, wherein said regenerated catalyst is blended with said spent catalyst to provide said blended catalyst, said regenerated catalyst conduit including instrumentation for determining the circulation rate of regenerated catalyst through said regenerated catalyst conduit; and

a recycle catalyst controller for setting a position of the recycle catalyst control valve dependent on whether a relationship between the circulation rate of spent catalyst through said recycle catalyst conduit and the circulation rate of regenerated catalyst through said regenerated catalyst conduit meets a preset condition.

12. A process for the fluidized catalytic cracking of hydrocarbons, the process comprising:

contacting blended catalyst with a hydrocarbon feed in a reaction zone;

separating effluent from said reaction zone into vapor product and spent

catalyst;

recycling spent catalyst to said reaction zone;

5 regulating circulation of said spent catalyst with a recycled catalyst control  
valve;

determining a circulation rate of spent catalyst to said reaction zone;

passing spent catalyst from said reaction zone to a regeneration zone;

removing carbon from said spent catalyst in said regeneration zone to provide

10 regenerated catalyst;

passing regenerated catalyst from said regeneration zone to said reaction zone;

determining a circulation rate of regenerated catalyst from said regeneration  
zone to said reaction zone;

blending said regenerated catalyst with said spent catalyst in said reaction zone

15 to provide said blended catalyst;

determining whether a relationship between the circulation rate of spent catalyst

to said reaction zone and the circulation rate of regenerated catalyst to said

reaction zone meets a preset condition; and

signaling an adjusted setting to the recycled catalyst control valve if said

20 relationship between the circulation rate of spent catalyst and the circulation  
rate of regenerated catalyst does not meet the preset condition.

13. The process of claim 12 wherein the relationship between the circulation rate of spent catalyst and the circulation rate of regenerated catalyst is the ratio of a sum of the circulation rate of spent catalyst and the circulation rate of regenerated catalyst to the circulation rate of regenerated catalyst.

5 14. The process of claim 12 including regulating circulation of regenerated catalyst with a regenerated catalyst control valve.

15. The process of claim 12 wherein said recycled catalyst and said regenerated catalyst are blended at the base of a riser in said reaction zone.

10 16. The process of claim 12 wherein said spent catalyst is stripped of hydrocarbons before being passed to said regeneration zone or recycled to said reaction zone.

17. The process of claim 12 including setting the position of the control valve relative to fully open.

15 18. The process of claim 12 including selecting a lowest setting of a signal from a recycle catalyst controller based on the relationship between the circulation rate of spent catalyst and the circulation rate of regenerated catalyst and a signal from at least another controller, and signaling said lowest setting to said recycle catalyst control valve.

20 19. The process of claim 18 wherein said another controller is selected from a pressure differential indicating controller and a temperature indicating controller.

20. The process of claim 12 wherein said spent catalyst is recycled to said reaction zone through a recycle catalyst conduit.